ACT Math Activator Problems 1-60

These problems were designed to be used with the ACT Math Activator Program. Try not to look at the problems until you begin the video program.

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1. A natural gas supplier charges residential customers a fixed monthly fee of $9.50 in addition to $1.50 per hundred cubic feet of natural gas used during the month. Which of the following expressions gives a residential customer's total monthly charges, in dollars, for using g hundred cubic feet of natural gas?

A. $9.50g + 1.50$
B. $1.50g + 9.50$
C. $11.00g + 9.50$
D. $150.00g$
E. $150.00g + 9.50$

2. Which of the following is a factored form of $16x^3 - xy^4$?

F. $x(4x + y^2)(4x - y^2)$
G. $(4x - y^2)(4x^2 + y^2)$
H. $(4x^2 - y^2)(4x + y^2)$
J. $4x(x - y^2)(x + y^2)$
K. $16x^2(x - y^2)$

3. The city of Midland budgeted $65,000 to increase the number of downtown parking spaces. The company hired to do the work charges $1055 for completing each parking space. If the first 30 parking spaces have been completed and billed to the city, how many more parking spaces can be completed without going over the budgeted amount?

A. 15
B. 31
C. 32
D. 61
E. 62

4. Which of the following expressions is equivalent to $5xy(2y + xy^2)$?

F. $15xy^2$
G. $10xy^2 + 5x^2y^3$
H. $5xy^2 + 5x^2y^3$
J. $15(xy)^2$
K. $10(xy)^2 + 5x^2y^3$

5. Upstate College requires that each student evaluate his or her instructors at the end of the semester by marking EXCELLENT, GOOD, FAIR, or POOR on an evaluation form. If Professor Kirsch taught a total of 450 students last semester, and the results of her students' evaluations are summarized in the pie chart shown, how many students rated her teaching either good or excellent?

A. 72
B. 189
C. 243
D. 324
E. 432

6. An ice cream shop offers 5 flavors of ice cream, 6 items that can be mixed into a scoop, and 4 toppings that can be poured over the scoop. How many combinations of one choice of ice cream, one mixed-in item, and one topping are possible?

F. 15
G. 30
H. 100
J. 120
K. 240

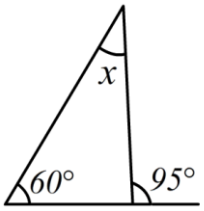
7. Juanita, David, and Lauren decided to work together to search for a lost dog. The friends agreed that if they found the dog, they would split the $200 reward proportionally, corresponding to how much time each individual spent searching. The next day, Juanita found the dog after she had searched for 5 hours, David had searched for 4 hours, and Lauren had searched for 6 hours. What was Lauren's share of the reward money, in dollars?

A. 40
B. 53
C. 67
D. 80
E. 120

8. The cost of a taco and a soda is $4.20. The cost of three tacos and a soda is $9.60. What is the cost of a taco, in dollars?

F. 1.35
G. 1.50
H. 2.00
J. 2.70
K. 3.20

9. The triangle shown has an interior angle that measures $60°$ and an exterior angle that measures $95°$. What is the measure of the angle labeled *x*?



A. 25°
B. 30°
C. 35°
D. 85°
E. 95°

10. If $a=3$, $b=2$, and $c=-1$, what is the value of $2a^2b+\frac{a-c}{a+c}+c^2$?

F. 15
G. 35
H. 37
J. 38
K. 39

11. What is the product of 3x-2 and 3x+2 ?

A. $6x$
B. $3x^2-4$
C. $9x^2-4$
D. $9x^2-x+4$
E. $9x^2+x+4$

12. What is the slope of a line passing through $(-7,2)$ and $(3,-1)$ in the standard (*x*,*y*) coordinate plane?

F. 1
G. 3
H. -3
J. $\frac{3}{10}$
K. $-\frac{3}{10}$

13. Dominic found two cans of the same color paint in his garage, one in a gallon-sized can and the other in a half-gallon-sized can. He estimated that the larger can was half full and the smaller can was one-third full. He poured all the paint from the smaller can into the larger can. Then, about how full was the larger can?

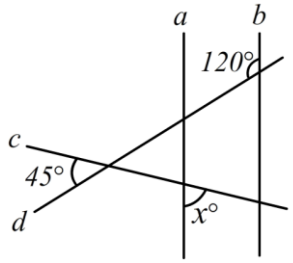
A. $\frac{2}{3}$
B. $\frac{3}{4}$
C. $\frac{1}{2}$
D. $\frac{5}{6}$
E. The can overflowed.

14. Mia is installing a patio in her back yard using concrete paving blocks. She has decided she needs one paving block for each 2-foot by 2-foot region. If she wants the finished patio to be a rectangle measuring 14 feet wide and 24 feet long, how many paving blocks does she need?

F. 84
G. 168
H. 196
J. 256
K. 336

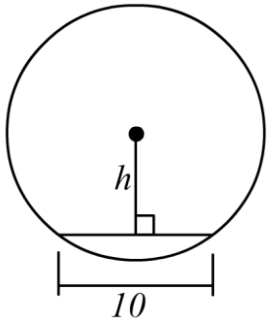
15. Lines *a* and *b* in the figure below are parallel, and transversals *c* and *d* intersect to form the angles shown. What is the value of *x*?

A. 45
B. 75
C. 85
D. 90
E. 120



16. A circle with a radius of 11 inches has a chord 10 inches long that is *h* inches from the center of the circle, as shown below. What is *h* to the nearest tenth of an inch?

F. 5.0
G. 5.5
H. 8.0
J. 9.8
K. 10.1

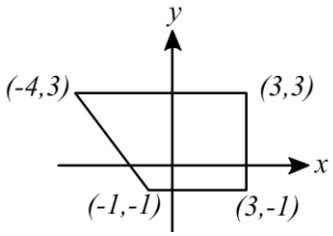


17. Japan's bullet train is capable of traveling at 500 kilometers per hour, but for safety reasons the speed is restricted to 300 kilometers per hour whenever the train is carrying passengers. If a bullet train could be used to travel from Chicago to Houston, a distance of 1700 kilometers, about how much less time would the trip take if the train were allowed to travel at 500 kilometers per hour for the entire distance, rather than restricting the speed to 300 kilometers per hour?

A. 2 hours, 16 minutes
B. 3 hours, 24 minutes
C. 5 hours, 40 minutes
D. 7 hours, 6 minutes
E. 9 hours, 4 minutes

18. A quadrilateral is shown below in the standard (x, y) coordinate plane. What is the area of the quadrilateral, in square units?

F. 15
G. 18
H. 21
J. 22
K. 28



19. Which of the following is a possible value of x if $3x^2 + x - 14 = 0$?

A. $\frac{7}{3}$
B. $-\frac{7}{3}$
C. 7
D. $\frac{2}{3}$
E. $-\frac{2}{3}$

20. What is one fourth of two thirds?

F. $\frac{2}{9}$
G. $\frac{1}{6}$
H. $\frac{1}{4}$
J. $\frac{1}{3}$
K. $\frac{1}{12}$

21. If the average value of the following five numbers is 23, what is X?

$$23, 27, X, 28, 16$$

A. 0
B. 21
C. 23
D. 28
E. 115

22. Ultimate Products produces high quality flying discs that meet the requirement $|M - 175| \leq 0.15$, where M is the mass of the flying disc, in grams. What is the minimum acceptable mass, in grams, of a flying disk produced by this company?

F. 87.35
G. 87.50
H. 174.85
J. 175.00
K. 175.15

23. Assume that the number of years of school completed by children ages 6 to 15 can be modeled by

$$N = \frac{5}{6}A - 4.5$$

where A is the age of the child in years and N is the number of years of school completed. According to this model, what is the predicted age of a child who has completed exactly 6 years of school?

A. 1.8
B. 7.2
C. 8.8
D. 11.7
E. 12.6

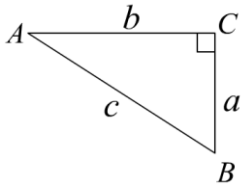
24. Consider the arithmetic sequence shown below. Which of the following statements about this sequence is true?

10, 7, 4, 1, …

F. The sum of the first five terms is 23.
G. The common ratio of consecutive terms is 3.
H. The common difference of consecutive terms is 3.
J. The 5th term is –3.
K. The 6th term is –5.

25. For the right triangle ΔABC shown, what is $sin\ \angle B$?

A. $\frac{a}{b}$
B. $\frac{a}{c}$
C. $\frac{b}{a}$
D. $\frac{b}{c}$
E. 1



26. Which of the following equations defines a line parallel to $4x + 5y = 20$?

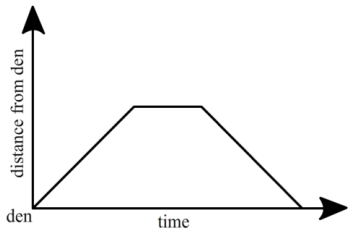
F. $y = -4x + 20$
G. $y = 4x + 20$
H. $y = -\frac{1}{5}x + 4$
J. $y = \frac{4}{5}x + 7$
K. $y = -\frac{4}{5}x - 2$

27. Find the median and mode of the 7 numbers shown below.

86, 77, 80, 92, 86, 78, 75

A. Median=75, mode=86
B. Median=82, mode=86
C. Median=86, mode=80
D. Median=80, mode=82
E. Median=80, mode=86

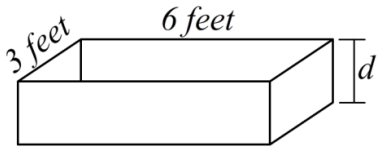
28. A wildlife biologist attached a tracking device to a brown bear in order to collect information about the bear's location relative to its den. The graph below shows the bear's distance from its den as a function of time on a particular day. Which of the following descriptions of the bear's activities best explains the graph?



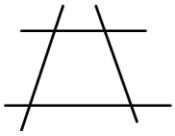
F. The bear did not return to its den.
G. The bear lost its tracking device in a field mid-morning.
H. The bear walked for awhile, then ran a short distance, then continued walking.
J. The bear walked to a berry patch, stopped to eat, and walked back to its den.
K. The bear climbed a tree and stayed there the rest of the day.

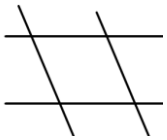
29. Josh used pre-packaged bags of garden soil to fill a box-shaped raised flowerbed with interior dimensions of 3 feet by 6 feet by *d* feet, as shown. The angles between the faces of the flowerbed are all 90°. If each bag contains 1 cubic foot of garden soil and Josh used exactly 27 bags to fill the flowerbed, what is *d*, in feet?

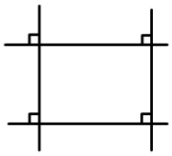
A. 1 ½
B. 2
C. 2 ½
D. 3
E. 4

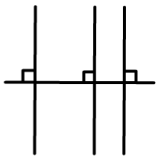


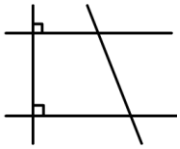
30. Distinct lines *p*, *q*, *r*, and *s* lie in the same plane with *p* parallel to *q*, *s* perpendicular to *p*, and *r* parallel to *s*. Which of the following sketches best represents the relationship between these four lines?

F. 

G. 

H. 

J. 

K. 

31. Find the y-coordinate of the point in the (*x*,*y*) coordinate plane at which the two lines $y = 3x - 1$ and $y = x + 1$ intersect.

A. $-\frac{3}{2}$

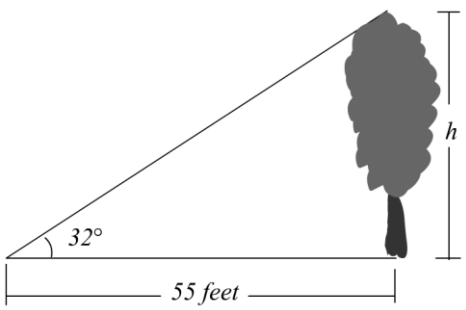
B. $\frac{3}{2}$

C. 1

D. 2

E. 3

32. Isabelle wants to find the height of a tree that is growing perpendicular to the ground. She determines that the angle of elevation to the top of the tree from a point on level ground 55 feet away from the base of its trunk is $32°$, as shown. Which of the following is an expression for the height, *h*, in feet?



F. $\frac{55}{\sin 32°}$

G. $\frac{55}{\cos 32°}$

H. $55 \tan 32°$

J. $55 \cot 32°$

K. $55 \sec 32°$

33. A survey was administered to all 160 juniors and S seniors at Canton High School. In the survey, 15% of juniors and 18% of seniors indicated that they plan to attend a college more than 500 miles from home. In terms of S, what fraction of the juniors and seniors at this high school plan to attend a college more than 500 miles from home?

A. $\frac{0.18S}{160+S}$

B. $\frac{24+0.18S}{160+S}$

C. $\frac{24+0.18S}{S}$

D. $\frac{24.18}{S}$

E. $\frac{1}{500}(160+S)$

34. Which of the following defines the solution set for the inequality $12-3x \leq 5$?

F. $x \geq \frac{7}{3}$

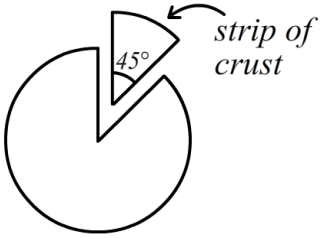
G. $x \geq \frac{3}{7}$

H. $x \geq -\frac{7}{3}$

J. $x \leq \frac{7}{3}$

K. $x \leq -\frac{3}{7}$

35. Garrett loves pizza but does not like the strip of crust left after he eats the inside part. His family is having a 16-inch diameter pizza for lunch with a narrow, circular strip of crust all the way around the outside edge. Garrett has been told that he must eat the crust from his first piece of pizza before he can have a second piece. If his first piece of pizza has an angle of 45°, as shown, about how many inches long is the strip of crust he must eat before taking a second piece?



A. 2.0
B. 5.1
C. 6.3
D. 8.3
E. 12.6

36. If a small, dense object is dropped from a cliff, the time it takes the object to fall is related to the distance fallen by the equation

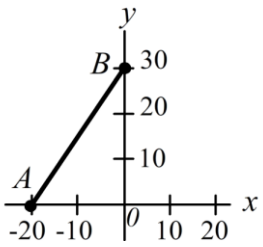
$$t = \sqrt{\frac{2d}{g}}$$

where t is the time in seconds, d is the distance in feet, and g is a constant equal to 32 feet/second^2. According to this equation, how much farther, in feet, will a dropped object fall in 3 seconds than in 2 seconds?

F. 4
G. 16
H. 64
J. 80
K. 160

37. About how many coordinate units long is the line segment, $\overline{AB}$, shown below in the standard (x,y) coordinate plane?

A. 20
B. 28
C. 36
D. 55
E. 490



38. If $x - 3 = y$, then $(x - y)^3 = ?$

F. −27
G. −9
H. 0
J. 1
K. 27

39. A triangle has side lengths with a ratio of exactly 9:10:15. In a second triangle that is similar to the first, the longest side is 10 inches. To the nearest tenth of an inch, what is the perimeter of the second triangle?

A. 22.7
B. 30.0
C. 34.0
D. 37.8
E. 38.5

40. Lindsey's car wouldn't start so she decided to run to work. She started at her apartment and ran straight south for one mile, then straight east for three miles, then straight south for three miles to reach the building where she works. If Lindsey had been able to run in a straight line from her apartment to the building, how many miles would she have run?

F. 5
G. 7
H. 10
J. $3\sqrt{2}$
K. $\sqrt{10}$

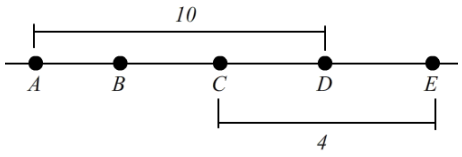
41. A number is decreased by 20% and the resulting number is then increased by 15%. The final number is what percent of the original number?

A. 68
B. 92
C. 100
D. 102
E. 138

42. If $y = t - 2$ and $x = y^2 + 3y - 1$, which of the following expresses x in terms of t ?

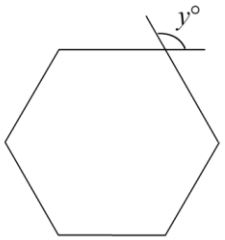
F. $x = t^2 - t + 1$
G. $x = t^2 - t - 3$
H. $x = t^2 + 3t - 3$
J. $x = t^2 + 3t - 1$
K. $x = t^2 + 2t - 3$

43. On the line below, the lengths of segments $\overline{AD}$ and $\overline{CE}$ are shown in meters. If point C is the midpoint of $\overline{BD}$ and the sum of the lengths of segments $\overline{AB}$ and $\overline{DE}$ is 5, what is the length of $\overline{BC}$?



A. 2.5
B. 3
C. 3.5
D. 4
E. The length of $\overline{BC}$ cannot be determined.

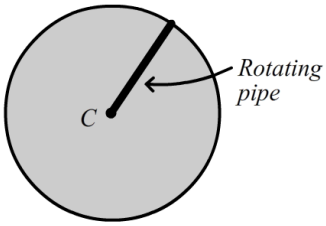
44. Two adjacent sides of a regular hexagon are extended to form an angle with a measure of $y°$. What is the value of y?

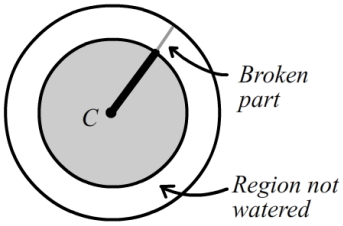


F. 60
G. 100
H. 110
J. 120
K. 160

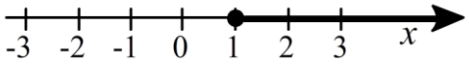
45. Center pivot irrigation is a method of watering crops using a water pipe that rotates around a central point, C, resulting in a circular irrigated region, as shown in the left diagram. Assume that a center pivot irrigation system is set up to deliver water to a circular field with a radius of 400 meters, but a breakdown occurs such that the last 100 meters of the pipe fails to deliver water, as shown in the right diagram. Approximately what percentage of the circular field is not watered?

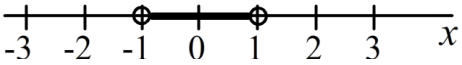
A. 15
B. 25
C. 44
D. 50
E. 56

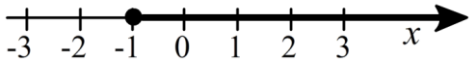


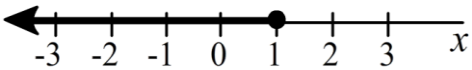


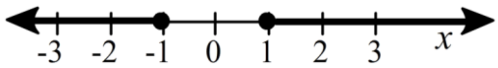
46. Which of the following number line graphs represents the inequality $|x| \geq 1$?

A.


B.


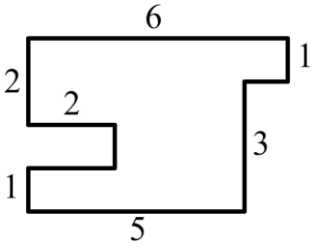
C.


D.


E.


47. In the figure shown below, all intersecting line segments meet at right angles, and the lengths are given in feet. What is the perimeter of the figure, in feet?

F. 18
G. 20
H. 22
J. 23
K. 24



48. A bag initially contains 9 green marbles, 6 blue marbles, and 8 red marbles. Ella randomly chooses two marbles from this bag, and both are green. What is the probability that the next marble she randomly chooses will also be green?

A. $\frac{1}{3}$

B. $\frac{7}{22}$

C. $\frac{7}{23}$

D. $\frac{3}{7}$

E. $\frac{2}{3}$

49. What is the matrix product $\begin{bmatrix} x \\ 5x \end{bmatrix}\begin{bmatrix} 2 & -1 \end{bmatrix}$?

F. $\begin{bmatrix} 2x & x \\ -10x & -5x \end{bmatrix}$

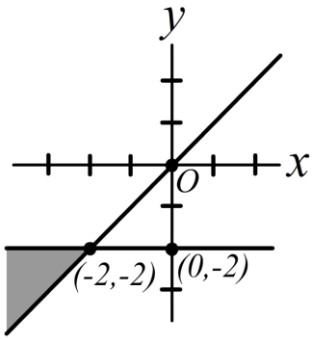
G. $\begin{bmatrix} 2x & -x \\ 10x & -5x \end{bmatrix}$

H. $\begin{bmatrix} x \\ 5x \end{bmatrix}$

J. $\begin{bmatrix} 2x & -5x \end{bmatrix}$

K. $-3x$

50. The shaded region between two lines in the graph below is described by which of the following systems of inequalities?



F. $y \geq x$ and $y \leq -2$

G. $y \geq x$ or $y \geq -2$

H. $y \leq x$ or $y \leq -2$

J. $y \leq x$ or $y \geq -2$

K. $y \leq x$ and $y \geq 0$

51. Gabe feeds the turkeys, chickens, and pigs on his family's farm every morning. There are three times as many chickens as turkeys, and 32 more turkeys than pigs. If x represents the number of pigs, which of the following expressions represents the total number of animals Gabe feeds?

A. $x+128$
B. $3x+96$
C. $4x+96$
D. $5x+96$
E. $5x+128$

Use the following information to answer questions 52-53.

Barr Industries is considering signing a contract with a car rental company in order to save money on employee business travel. There are two car rental plans being considered: under Plan A, car rentals are $40 per day plus $0.10 per mile, and under Plan B car rentals are $50 per day with no extra charge for mileage.

52. If a car is rented for 3 days, how many miles must the car be driven to result in exactly the same rental charges under Plans A and B?

F. 100
G. 200
H. 300
J. 700
K. 1100

53. The table below shows four planned car rentals by Barr Industries employees.

Employee	Length of rental (days)	Approx. distance (miles)
Sami	2	35
Jack	1	20
Jessica	8	700
Mary	3	230

The following matrix was formed based on the table: $M = \begin{bmatrix} 2 & 35 \\ 1 & 20 \\ 8 & 700 \\ 3 & 230 \end{bmatrix}$

The matrix M is multiplied by a matrix X so that the resulting matrix $M \cdot X$ consists of two columns, with the left column showing the cost for each rental under Plan A, and the right column showing the cost under Plan B. Which of the following should be used for X?

A. $\begin{bmatrix} 50 & 40 \\ 0 & 0.10 \end{bmatrix}$

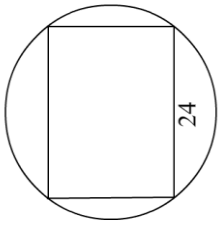
B. $\begin{bmatrix} 40 & 0.10 \\ 50 & 0 \end{bmatrix}$

C. $\begin{bmatrix} 40 & 50 \\ 0.10 & 0 \end{bmatrix}$

D. $\begin{bmatrix} 40 & 0 \\ 50 & 0.10 \end{bmatrix}$

E. $\begin{bmatrix} 40 & 50 \\ 0 & 0.10 \end{bmatrix}$

54. One dimension of a rectangle inscribed in a circle is 24 centimeters, as shown below. If the radius of the circle is 15 centimeters, what is the area of the rectangle, in square centimeters?



F. 108
G. 144
H. 216
J. 432
K. 576

55. For $0 < x < \pi$, the expression $\dfrac{\cos x}{\sqrt{1-\cos^2 x}}$ simplifies to:

A. $\cos x$
B. $\sin x$
C. $\cot x$
D. $\tan x$
E. $\sec x$

56. If $\cos\theta = -\frac{4}{5}$ and $\frac{\pi}{2} < \theta \leq \pi$, then $\sin\theta = ?$

F. $-\frac{3}{4}$

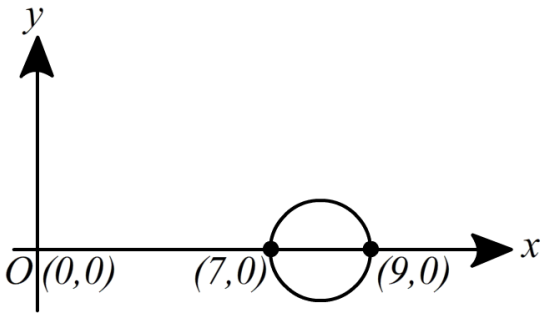
G. $-\frac{3}{5}$

H. $\frac{3}{5}$

J. $\frac{3}{4}$

K. $\frac{4}{3}$

57. The circle shown below in the standard (x,y) coordinate plane has its center on the x-axis. Two points of the circle are located as shown. Which of the following is the correct equation for this circle?



A. $x^2 + (y-8)^2 = 4$

B. $x^2 + (y-8)^2 = 1$

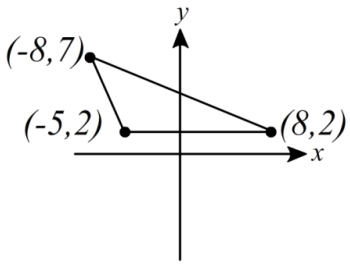
C. $(x-8)^2 + y^2 = 4$

D. $(x-8)^2 + (y-1)^2 = 2$

E. $(x-8)^2 + y^2 = 1$

58. A triangle in the (x,y) coordinate plane is defined by three points, as shown below. If this triangle is reflected across the x-axis to form a new triangle, which of the following points is one of the three defining points for the new triangle?

F. $(8,7)$
G. $(-8,7)$
H. $(-5,-2)$
J. $(-8,2)$
K. $(2,-5)$



59. If $\log_b x = p$ and $\log_b y = q$, then $\log_b \left(\frac{x^2}{y} \right) = ?$

A. pq
B. $4pq$
C. $2p+q$
D. $2p-q$
E. $2(p+q)$

60. Let z equal $x+3y-7$. What happens to the value of z if the value of x increases by 2 and the value of y decreases by 2?

F. It increases by 4.
G. It is unchanged.
H. It decreases by 2.
J. It decreases by 4.
K. It decreases by 11.